Midterm Exam (2015 Summer)

PHYS 203A: College Physics

Date: 2015 Jun 26

(Name) (Signature)

Instructions

1. Total time = 60 minutes.
2. There are 8 questions in this exam.
3. Equation sheet is provided separately.
4. To obtain partial credit for your work you need to show your work in detail and organize it clearly.
5. A simple calculator (with trignometric functions) is allowed.

1. (**10 points.**) Newton's gravitational force between two objects of masses m_1 and m_2, which are separated by a distance r, is given by

$$F = G\frac{m_1 m_2}{r^2}. \tag{1}$$

If you are informed that force has the dimensions MLT^{-2}, what should the dimension of G be for the above equation to be dimensionally correct?

2. (**10 points.**) Convert $2.0\,\mathrm{m/s^2}$ in $\mathrm{mile/hour^2}$.
   Given: $1\,\mathrm{mile} = 1609\,\mathrm{meter}$.

3. (**10 points.**) A jogger runs 1.50×10^2 m in a direction 30.0° East of North and then 1.00×10^2 m in a direction 45.0° South of East. Determine the magnitude and direction of the total displacement of the jogger.

4. (**10 points.**) Two geological field teams are working in a remote area. A global positioning system (GPS) tracker at their base camp shows the location of the first team as 35 km away, 30° North of West, and the second team as 32 km away, 45° East of North. When the second team uses its GPS to check the position of the first team, what does the GPS give for the following?

   (a) The first team's distance from the second team.

   (b) The first team's direction from the second team.

   Caution: In the homework question the first team uses its GPS to check the position of the second team.

5. (**10 points.**) A small fish is dropped by a pelican that is rising steadily at 6 m/s when it is 50 m above the ground. How much time later does the fish hit the water?

6. (**10 points.**) A speeder passes a parked police car at 40 m/s. The police car starts from rest with a uniform acceleration of 3 m/s^2. How far does the speeder get before being overtaken by the police car?

7. (**10 points.**) A VW Beetle goes from 0 to 30 m/s with an acceleration of $+2.36\,\mathrm{m/s^2}$. What is the displacement of the Beetle in this process?

8. (**10 points.**) A key falls from a bridge that is 46 m above the water. It falls directly into a model boat, moving with constant velocity, that was 11 m from the point of impact when the key was released. What is the speed of the boat?